The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Safety First

These pages are a monthly feature devoted to announcements in the interests of safety in Works and Laboratories.

Safety First

The Chemical Age

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Science and International Politics

THE over-facile teaching of children's history books indicates that wars in the past may have arisen from the personal antipathies of sovereigns; but who would now believe seriously that a war that ranks high in English history started because the king of France sent to the king of England a derisive gift of tennis balls? Personal antipathies may start feuds under tribal conditions, but not in civilised nations. Will the historians of the future be likely to rate, as the prime cause of two great Anglo-German wars, the dislike of King Edward VII for the late Kaiser, which caused him to declare that "the fellow is no gentleman"? The causes of war have always lain deeper than that, though a trifling incident may have struck the spark that fired the match that set the powder alight. Fundamentally we believe that wars have arisen because one nation has something that another wanted — the operative word "wanted" being variously interpreted as ranging from desire to an imperative necessity to possess as a condition of survival. Into that last category we may place the rape of the Sabine ladies by Romulus and his early Romans. Of the wars in more recent times it is arguable that most have had their origin in the desire for material possessions, comprising territory, command of the seas to obtain a shipping monopoly, or raw materials, and it would now seem that science and technology may be able to direct human activities into more peaceful channels. Thus the senseless demand once heard for a holiday from scientific discovery may perhaps be shown as defeating its own object.

Science has already had a profound effect on the lives of all mankind in Europe and America. Africa and India have been brought increasingly under its sway. Asia will surely follow. Australia was born as a nation after the rise of science. The first effect of the application of science in Europe has been to improve the lot of all men. We have on our shelves a book, "The Century of Science," by Dr. Sherwood Taylor, which shows how the onward march of science over the last century or so has given us transportation by steam engine and aeroplane and steamboat such as our forefathers hardly dreamed of; how it has led to striking increases in the population (though the subsequent decline is causing anxiety to all

On Other Pages

civilised nations); how medicine and public health, combined with the war against dirt and disease, have immensely reduced pain and suffering; and how working hours have been shortened, and the toil of life lightened. In fact, although we may not yet have reached the millenium, through the application of science to daily life, nor even have come within the most distant view of it, we have undoubtedly travelled a vast way with inconceivable rapidity during the past 100 years. It took mankind millions of years to make even the tiniest first step; but within the past few centuries the curve of progress in countries that have applied science intensively has risen with parabolic velocity, and is so continuing to rise.

As science becomes applied in the more backward regions of the earth, we may expect them to go through the same process as we have seen in Britain. That means two things, one of them desirable, the other possibly leading to international problems. The desirable consequence is that the standard of living in those countries will rise; they will want more goods and the nations that have already travelled the path will have to supply them, or the means to manufacture them, for they alone know how to make the things that are needed. Therein we see employment and prosperity for ourselves for another hundred years in bringing it to the remainder of the world. But we can also see that a consequence of bringing more of the amenities of life to the backward nations will be an immense increase in population. That may lead some nations, as it has led Japan, to find that territorial expansion is essential to survival, with further destructive wars as a consequence.

Science, however, has another word to say on this question of territorial expansion. The population of London and of New York reaches a density in units per square mile far greater than that of any country, and, provided that foundations will stand the strain, it is always open to any country to build higher into the sky; yet the populations of these cities contrive to live and to prosper exceedingly. Science is marching towards a goal when population density will be a meaningless catchword. The kindly fruits of the earth can be brought at any season, through any climate, to any spot where men desire them. The problem of feeding any population has been reduced to a matter of transport—and of the power to purchase from abroad.

The problem of purchasing from abroad with the possibility of having insufficient assets to meet the bill strikes us as just one of the unsolved problems of economic science, and one that must be solved if further progress is to be made. It happens that our monetary system is based on making income balance expenditure. Mr. Micawber completely summed up that system: "Annual income twenty pounds, annual expenditure nineteen, nineteen six, result happiness. Annual income twenty pounds, annual expenditure twenty pounds, ought and six, result misery." That was the economics of the Victorians, but should it be the economics of the twentieth century? Is it not possible, for example, to devise a system whereby every individual is entitled to a minimum subsistence allowance in kind from the fruits of the earth, and that his income is reserved for the purchase of luxuries?

The trend of development to-day is in the direction of the manufacture synthetically of many substances that previously had to be conveyed from those parts of the earth in which they were found. Many examples of the effect on international politics of this development were given by the late Harrison Howe in his address in November last when receiving the Chemical Industry Medal. Chilean nitrate and its partial supersession by synthetic nitrates from the air was among the most important. The manufacture of sugar from beet, the manufacture of margarine, the breaking of the German potash monopoly, the synthetic manufacture of toluene from petroleum, the rise of the artificial silk industry, and now the large-scale manufacture of fuels for the internal combustion engine and of synthetic rubber are all examples of the same character. Ultimately, synthetics will render unnecessary many of the great agricultural activities that require large areas of the land surface. We are only at the beginning of the chemical age. Many of our present ideas must be scrapped before we can reap to the full the advantages that will accrue from the widening impact of science.

NOTES AND COMMENTS

A Handicap in Industry

THOSE who have been arguing that there should be increased tax allowances in respect of industrial research and obsolescence, must have welcomed, as we did, the support which this principle has received from the able pen of Mr. Oscar R. Hobson, city editor of the *News Chronicle*. In an article headed "A Handicap on Industry," he calls attention to the disadvantage at which the British chemical manufacturer is placed in these respects compared with his overseas competitors. Under the American, German and Swiss tax systems the overwhelming bulk of expenditure on research and obsolescence could be written off against profits. In Britain, on the other hand, only what may be called "routine research" is chargeable against revenue. True research—what Mr. Hobson calls "exploratory research aiming at the development of entirely new processes and products"—is treated as capital expenditure which has to be amortised out of taxed profits. Similarly, in the allied matter of plant obsolescence: under our established fiscal practice extra depreciation, that is depreciation over and above the very modest allowances laid down for machinery and buildings, is allowed only if the plant in question is actually scrapped, a wasteful and extravagant procedure if the plant could be adapted for further use.

Fiscal Inequity

MR. HOBSON advocates early removal of these handicaps on industrial progress; firstly, because tax rates are now unprecedentedly high and are likely to remain so for some years after the war, so that the burden of these fiscal disabilities on industry is increased correspondingly; "a fiscal inequity may in practice not be worth bothering about with income tax at 2s. or 3s. in the £, with tax at 10s. it may be crippling." Mr. Hobson's second reason why the handicap must be removed is more fundamental, being concerned with the danger of our losing ground on some sectors of the technological front, as, for instance, plastics, synthetic rubber, nylon, and petroleum chemistry. Politicians have added the word "research" to the vocabulary with which they describe their dreamlands. They are as proud of their new acquisition as of a new Rolls-Royce, and show it off at every opportunity. But for a politician to impress his constituents with a motor car he would need to take the brake off. One of the brakes on research is this tax disability; it is imperative that the politicians release this brake forthwith.

Suggestion Boxes

THOUGH there seems a certain amount of divergence of opinion as to the actual method to be employed, it appears to be universally acknowledged that the "suggestion box," in which employees may put their suggestions for alterations in factory practice, is a good idea. The mere fact that there *is* divergence of opinion is also a good thing, as it has led to a certain amount of parliamentary publicity for the suggestion-box system. The main point at issue is whether employees are actuated purely by mercenary motives when making suggestions, or whether they are sufficiently interested in the good progress of the factory to insert their suggestions in the box irrespective of any hope of monetary award should the suggestion be adopted. When the Minister of Production, in reply to a question in the House, said that he and his colleagues were doing all they could to encourage the use of suggestion boxes, Mr. Simmonds, M.P. for Duddeston, asked him to emphasise to industry that the system was of no real use unless adequate rewards were made for adopted suggestions. In a letter to *The Times*, however, Mr. Walpole, chairman of Masson Seeley & Co., Ltd., denies that this is necessary, and states that the employees of his firm, through the joint works council, had expressed the strong view that they should accept *no* reward for their suggestions, at any rate for the duration of the war. This last opinion fits in with what Mr. Bond, of Dunlops, was quoted in our last week's issue as having said on this subject. Although awards are made at Fort Dunlop for valuable suggestions, the general impression is that personal initiative is the prime motive for the suggestions, rather than the expectation of cash down.

Synchronised Attack

LIAISON in operation between the Air Ministry and the Ministry of Economic Warfare becomes ever closer as the air war aginst Germany intensifies. The pattern of the bombing offensive, from Hamburg to Ploesti, is seen to be ever more symmetrical and purposeful. Obviously, it is far more practical to stage simultaneous attacks against the supply of natural petroleum and the manufacture of synthetic petrol than to deal with each of them piecemeal; to put Gelsenkirchen and Ploesti out of action at once implies only a third devastation, this time of Leuna, to raise an almost insuperable fuel problem for the Nazis. It is, moreover, no mere coincidence that the attacks on the heavy primary industries of the Ruhr should have been followed up by a pounce on the textile and other factories of the Wupper, which make use of the Ruhr steel and machine tools.

No Chemicals, No Clothes

THE suspension of the clothing ration in Germany has, no doubt, a closer connection than perhaps we realise with the battering of the chemical works of Mannheim and Ludwigshaven. In those factories are manufactured the chemicals from which the ersatz yarn for the poor-quality German clothing is developed. The direct effect of the raids all over Germany has, of course, been to increase the demand for clothing for the bombed-out; and it is probable that all available clothing is now being issued to municipal authorities for immediate relief purposes. All this is over and above the increasing demands of the military machine for more men and more munitions; and for these last the surprise attack on Wiener Neustadt must have been well nigh the last straw. The mighty German war-machine is now occupied mainly in devising palliatives, and it will be interesting to see how long the Nazi propaganda voices can manage to keep the Germans persuaded that it is worth while carrying on.

South Africa's Research Needs

ANOTHER part of the British Empire which is fast realising the need to encourage research is South Africa. In his presidential address to the Natal Institute of Engineers, Dr. E. P. Hedley presented the case for intensifying research in the Union in a manner which must have left his listeners with few, if any, grounds for disagreement. He took the view that in developing South Africa's industries they should concentrate on their primary industries and from these develop secondary industries to utilise the products and by-products as much as possible. Taking copper as one example, he argued that South Africa must not be content to mine it and then send it overseas for refining. He also foresaw that the Union's 10,000 factories would not be able to maintain their position unless they embarked upon a policy of continually improving processes and products by means of research. Self-satisfaction with present results would lead to trade going to more progressive manufacturers overseas, as happened to the British trade in optical instruments and dyestuffs a quarter of a century ago. Dr. Hedley recommended the development of research associations similar to those set up in this country.

Lac Utilisation

WE have more than once commented upon, and commended, the work that India is doing towards extending its industries. A new step in this direction is indicated in an announcement in our "Personal Notes" this week, in which the proximate departure of Dr. A. J. Gibson from the post of Special Officer Lac Inquiry is recorded. From then on, an all-Indian team of shellac workers will devote themselves to the furthering of India's lac industry. Maintenance of the lac industry as a profitable feature of India's economy is no easy task. The research workers will find themselves faced with several knotty problems, not the least of which is the formidable competition of synthetic resins. It is probable, too, that the supply of lac will tend to dwindle, and the prices to rise in sympathy. But the principal task of the workers in lac will be to win the confidence of consumers in order to have lac utilisation problems submitted to them. This is not an insuperable task, but it is one beset with all manner of difficulties, and they will need all their resource and experience to win the day for their country.

A Chemical Future for S. Wales

Mr. W. C. Devereux's Proposals

OF all the areas that suffered the effects of the economic depression in the 1930's, South Wales was hit the hardest. It was apparent that without the radical introduction of new industries there was little chance of recovering former prosperity. Now, in a pamphlet entitled "Post War Reconstruction of Industry in South Wales" (published by the *Western Mail*, price 6d.), Mr. W. C. Devereux, who is chairman and managing director of two important concerns, High Duty Alloys, Ltd., and Ocean Salts (Products), Ltd., has some interesting suggestions to make with regard to the types of industry that should be developed in South Wales. In his introductory remarks he describes as short-sighted the policy, practised in Wales for years, of restricting the exploitation of her reserves to the "export" of raw coal to other parts of Britain and abroad. He envisages that coal could become not only an abundant source of electrical power but also the basic raw material for many chemical industries, such as synthetic rubber, synthetic oil, and plastics production. It should be possible to produce electrical power from coal at an economic price, say 0.13d.–0.15d. per unit: with the provision of electricity at a suitable price South Wales would be a reasonable location for the establishment of electro-metallurgical industries.

With recent improvements and advances in metallurgy, the electro-metallurgical and electro-chemical industries can be taken to include the manufacture of magnesium, aluminium, ferro alloys, including ferro-silicon, ferro-chromium, ferro-tungsten, ferro-vanadium, etc., and the location of the coalfield near well equipped sea ports makes South Wales not only favourable but attractive for these industries. On the assumption that electricity and coal are available and taking into account the facilities which South Wales has to offer, the following scheme for an integrated industry is recommended. This is shown diagrammatically in the form of a flow sheet. (Fig. 1).

In order to give a picture of what is involved in the manufacture of aluminium using the present-day Bayer Process, Mr. Devereux quotes the following extract from Market Control in the Aluminium Industry: "One metric ton of aluminium requires three to four h.p. years of electric energy, four to five tons of bauxite, four to five tons of coal, a substantial amount of water, about one ton of caustic soda, and 0.5 to 0.6 of a ton of electrodes—altogether over ten tons of materials, plus a large quantity of power. In the absence of large differences in labour and capital costs between regions, it is obvious that aluminium could be produced at the lowest expense where cheap power, good bauxite and cheap coal exist in fairly close proximity. There is no place in the world, however, where these three are localised within a fairly small region." Mr. Devereux considers that, with the possible exception of France, few countries are favourably situated for the production of aluminium by the Bayer process, which at present is being operated at an economic disadvantage in comparison with a process which could obtain all the requirements of materials near the coalfield. Briefly, the alternative process which is proposed, the flowsheet of which is shown in Figure 1, consists of reducing shale in an arc furnace with coke to form ferro-silicon-aluminium which is afterwards electrolysed to give substantially ferro-silicon and aluminium. The shale is preferably pretreated to remove volatile constituents which may be collected in the form of oil—the gases evolved being used for heating the shale. Alternatively or simultaneously, alumina of a very high degree of purity—suitable not only for aluminium production but also for the manufacture of electrical apparatus—may be made

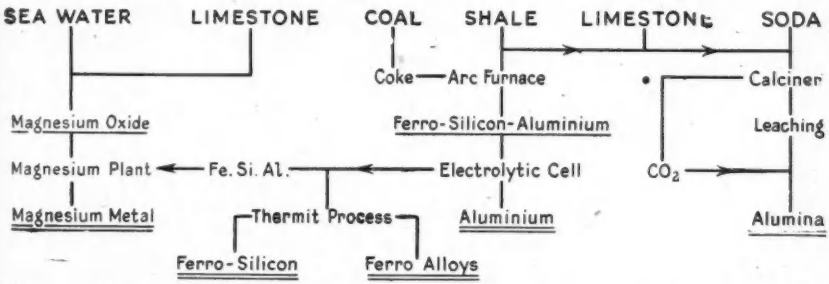


Fig. 1.—Flow sheet for proposed electro-metallurgical industry. The saleable commodities are underlined: the double line indicates the end products.

cheaply from shale by a modified lime-soda process in which silica contamination of the ultimate product is avoided by the addition of a reagent to the clay or shale. (The action of this reagent is not known precisely, but probably operates in virtue of the formation of insoluble silicate).

These processes for the manufacture of aluminium are attractive since the raw materials —in contrast to the Bayer process—occur in one locality, *i.e.*, at the coalfield; assuming, of course, that the electricity is developed thermally. They are also attractive, since a valuable reducing agent, namely ferro-silicon with some quantity of aluminium present (20-25%) is produced as a by-product. This material is largely used in steel making and for the production of ferro alloys — ferro-chrome, ferro-titanium, etc. — by thermal reduction. Moreover, it is an excellent reducing agent for the manufacture of magnesium by reduction of magnesium oxide. The production of aluminium in South Wales from local raw materials at a cheap price would have a profound effect on the problem of employment, since the district is suitable for the manufacture of fabricated parts which would give rise to further employment and, in view of the almost certain increase in the use of light alloys after the war, the importance of this development cannot be over-emphasised.

The magnesium industry, which consumes upwards of 12-14 kWh. per lb. of magnesium, depends primarily on the availability of cheap electricity. With the introduction of the sea-water process to this country the raw materials question—namely, magnesium oxide —is answered, since here again, if coal is procurable in the right quality at a favourable price, the production of all grades of magnesium oxide from sea water presents no difficulty, and under certain conditions would be an economic undertaking even in peace time.

Oil from Coal

It would now be of interest to deal briefly with the use of coal for the production of oil. The only raw material required for this industry is coal, and the industry is one excellently suited for vertical expansion. The synthetic oil industry has already reached an advanced state of development in Germany, where a whole series of products varying from high octane aviation spirit and motor fuel to diesel oil and fuel oil is being produced in very large quantities. Had it not been for the development of this industry over the ten years preceding the war, Germany would have been quite unable to undertake a major offensive war. Our position is in many respects analogous to that of Germany, in that we have very little in the way of indigenous oil supplies, but we have ample coal reserves. The establishment of hydrogenation plants in the country has been considered from time to time, but progress has not been substantial due largely to lack of enterprise and the difficulty of raising sufficient capital for the establishment of an industry which can be operated satisfactorily only on a very large scale. What has been achieved has been due chiefly to the efforts of industries other than the coal-mining industry.

The success of any new industry depends to a large extent on the amount of research and development which is carried on prior to, and simultaneously with, its establishment. In this country we are particularly slow in appreciating this fact and in recent years there seems to have been a tendency, with certain notable exceptions, to avoid establishing any new process until its success has first been proved in some other country. It is frequently claimed that the synthetic oil industry is not economically sound and can only be operated with protection, but with research and with greater expansion of the chemical industry as a result of recent technical advances in the application of plastics, this industry may be expected to take an increasingly active part in our future economy.

Solving a Complex Problem

Briefly, there are two main processes for producing oil from coal: the Bergius process which operates at high temperature and pressure, giving a high yield of motor spirit of excellent quality; and the Fischer-Tropsch process, which operates at atmospheric or slightly elevated pressure and moderate temperature to yield an inferior grade of petrol, which normally requires further treatment, and diesel oil of highest quality. The above processes, although excellent in themselves, do not constitute a complete solution to our fuel problem, since they leave untouched the problem of domestic heating which is responsible for great wastage of our coal resources. It is probably not possible, even if it were desirable, to persuade the public to abandon the open fire in favour of some form of central heating, but the problem can be solved by substituting a prepared fuel for raw coal as a domestic fuel. This is best achieved by means of low-temperature carbonisation. Furthermore, the development of low-temperature carbonisation results in the production of a certain amount of oil. However, the oil yield is not very high, and from one ton of coal it is possible to obtain only about three gallons of motor spirit, together with 18 gallons of crude coal oil, which has in the past been difficult to dispose of, except as fuel oil at an uneconomic price. By distillation and refining it is possible to produce from the coal oil six or seven gallons of oil suitable as a low grade diesel fuel. The total yield of refined oils, from one ton of coal, is not greater than ten gallons, and accordingly to obtain an annual oil production of ten million tons would require the treatment of 250 millions tons of coal, a quite impossible figure. Furthermore, from every ton of coal carbonised, 15 cwt. of smokeless fuel is obtained, the maximum demand for which would be 35

million tons, equal to the present consumption of domestic coal.

The problem can, however, be solved by a combination of low-temperature carbonisation with the Fischer-Tropsch synthesis process, in which the rich gas from the L.T.C. plant is decomposed with steam to yield a mixture of hydrogen and carbon monoxide, which is suitable as a raw material for oil synthesis. This gas is usually employed for heating the retorts, and is not available as a saleable product, but this is clearly a wasteful mode of operation. An improved method of operation would be to utilise producer gas for heating the retorts, as is done in a gas works or coke oven plant, the retort gas being used for synthetic processes. The producer gas would be generated from high-temperature coke manufactured in a high-temperature carbonising plant, preferably consisting of a battery of vertical retorts. The coke in addition to being used for heating both high- and low-temperature carbonising plants, would also be used for the manufacture of water gas. The gases from the two plants would be mixed, purified, and treated with steam to decompose the hydrocarbons into hydrogen and carbon monoxide in accordance with the equation—

$$CH_4 + H_2O = CO + 3H_2.$$

For oil synthesis, the ratio of hydrogen to carbon monoxide should be 2 to 1, and in order to obtain this ratio it is necessary to mix the above gas with water gas generated from coke as previously mentioned.

Typical Carbonisation Products

The products obtained from the carbonising plants, with the coal equally divided between low- and high-temperature retorts would be, in a typical case, as follows :—

Low temperature coke ...	7.5 cwt.
Light oil and benzol ...	2.5 galls.
Middle oil and heavy oil ...	5.5 galls.
Crude tar acids	3.5 galls.
Pitch	130 lb.
Gas	11,000 cu. ft.

and in addition, 5 cwt. of high temperature coke, which would be consumed in the water-gas generators. The gas obtained by mixing the retort gas, after steam treatment with water gas, would amount to 37,500 cu. ft., and after purification to remove all traces of sulphur compounds, would be treated in a Fischer-Tropsch plant, in which the gas at a temperature of 200°C. and atmospheric pressure is passed over a catalyst consisting of cobalt and thorium oxides to give a 75 per cent. conversion to oil.

The products obtained from the synthesis plant, after distillation, would give the following yield of oils, referred to one ton of coal.

Light products	4.5 galls.
Motor spirit	22.5 galls.
Diesel oil	15.0 galls.
Paraffin wax	20 lb.

The motor-spirit fraction would be blended with the benzol and light oils from the carbonisation retorts, giving a total yield of 25 gallons of motor spirit, and the diesel oil would be blended with the middle and heavy tar oil fractions, giving altogether 20.5 gallons of diesel oil.

The total products obtainable from one ton of coal, treated in the manner here described may now be summarised.

Smokeless fuel	7.5 cwt.
Butane and propane ...	4.5 galls.
Motor spirit	25.0 } 50 galls.
Diesel oil	20.5 }
Refined tar acids	3.0 galls.
Paraffin wax	20 lb.
Pitch	130 lb.

The process as outlined above does not contain any insuperable technical difficulties. The necessary plant would consist of coal-blending units, vertical retorts for carbonising at high and low temperatures, preferably working continuously, tar-distillation plant, oil-synthesis section, and refinery, together with the necessary ancillary plant.

The extent to which the process could be developed would depend on the quantity of coal of the right type which might be available. This again is controlled by the correct utilisation of coal. Since there is a relatively small production of high volatile coal in South Wales, it is most necessary to avoid using any of the coking coal for steam raising. If all the coal were used to the best advantage, then it is considered that the amount of coal available in South Wales for oil synthesis would be in the neighbourhood of eight million tons annually. This quantity would be offset by a saving of 3,000,000 tons of domestic coal, which would be replaced by smokeless fuel. The value of the products obtained from this amount of coal, based on 1938 prices, would be about £20,000,000.

Tar-Acid Treatment

The tar acids, on distillation and refining, give a number of useful products, such as phenol and cresol, which are the basis of bakelite resin, together with cresylic acids of various grades which are used for ore flotation, and the manufacture of disinfectants. It has frequently been emphasised in the past that new sources of tar acids must be found in order to fulfil the ever-increasing demand of the plastic industry. In addition to the main products, appreciable quantities of "calor gas," consisting of liquefied propane and butane, are obtained, which might be used for heating and lighting in country districts and should find a ready export market; also a high yield of paraffin wax is obtained. Pitch has not been included in the products, as it is doubtful whether markets could be obtained, but it could be utilised on the plant as a fuel for steam raising and other purposes. Likewise the ammonium liquors have not been taken into account, as they are also regarded as waste

products. The capital cost of the plants which have been described would undoubtedly be high, and Government assistance would be required in order to raise the required capital at a low rate of interest. However, the writer is convinced that the process described could be operated successfully both from the technical and economic view point, provided that the oil duty did not exceed threepence per gallon.

Smokeless Fuel

The production of an annual total of 1,350,000 tons of oil would be an important contribution to the national economy, particularly in the post-war period, when it will be necessary to reduce our imports and increase exports. In addition to oil production, the process will render available 3,000,000 tons of smokeless fuel, i.e., about six times the present output from all sources (other than anthracite). A works cost of 20 shillings per ton for smokeless fuel would enable this fuel to be sold at the same price as coal, which would be replaced to the extent of 3,000,000 tons by a material which could readily be burnt in the open grate, and would have a considerable effect in reducing the harm known to be caused by smoke and soot emitted from the domestic grate. In addition to providing employment for 30,000 men on the processing plants, a further 10,000 men would be required at the collieries, and in addition men would be needed in large numbers for erecting the plant. Labour for construction works would be required at a time when large numbers of skilled and semi-skilled men were being released from the services, and hence the scheme would be of great value during the transition stage from a war to a peace-time economy.

With regard to research, we have the necessary personnel available, and it is largely a question of planning and organisation. Furthermore, many of Germany's leading fuel experts are now present in this country, unable to make any proper use of their scientific knowledge and experience. As to capital, Mr. Devereux is convinced that there is no real obstacle that cannot be overcome when the importance of the matter is duly considered.

Sea-Water Industries

The sea has long been recognised as a vast store of potential wealth, but apart from fishing and the industries associated with it, little attempt has been made until recently to tap its valuable resources. This is perhaps an over-statement, since certain inland seas, notably the Dead Sea, in which natural concentration has occurred, have been used as sources of certain chemicals, including common salt, potassium chloride and magnesium chloride. Further, in Scotland, iodine has been extracted from seaweed, which is also a source of food in coastal regions in many parts of the world, particularly Japan.

It has been felt, however, that the resources of sea water have been neglected, particularly if we realise that a cubic mile of sea contains over 100 million tons of sodium chloride, over four million tons of magnesium, over five million tons of potassium chloride and equally surprising quantities of aluminium, copper and iron, but the reclamation of these materials has hitherto presented formidable problems to the chemist and engineer. Before this war, however, a number of companies operating independently were either investigating the possibilities or were actually recovering products. For instance, in America and England, magnesium oxide and bromine were being made, while in Norway, it is understood, plants were erected for the recovery of potassium. In order to get some comparative idea of the store of natural wealth present in sea water, it might be of interest to state that in order of concentration the following, elements are present: chlorine, sodium, sulphur, magnesium, calcium, potassium, bromine, boron, strontium, while even silver and gold are present in minute quantities.

Magnesium and Bromine

The recovery of magnesium oxide and bromine are both established industries which are likely to play a large part in post-war economics. The former commodity is used largely for the manufacture of magnesium metal, refractories and pharmaceutical products, while bromine is an important constituent of anti-knock fuels, and is used in photography and pharmacy. The recovery of gold and silver, however, is so difficult that it is hardly ever likely to become a commercial proposition. The extraction of magnesium oxide and bromine from sea water might be combined with the recovery of potassium—this country being particularly dependent on outside sources for this commodity, which is valuable as a fertiliser. Magnesium oxide, bromine and potassium would form a valuable basis for an extensive chemical industry, since our imports of chemicals, based on these, amounted in 1938 to a value of over £2,000,000.

The raw materials required for the extraction of magnesia—namely, limestone and dolomite, are fortunately in plentiful supply in South Wales, and it is also fortunate that, as regards limestone at any rate, the quality is excellent, while coal and electricity which are essential to these industries are in plentiful supply. Coupled with these factors, the coastline is extensive and the shipping and transport facilities add greatly to South Wales's claim as a suitable location for these industries.

The subject of sea water as a raw material cannot be dismissed without reference to its vegetation, in the form of seaweed, which may be used directly as a fertiliser or in special cases as a food. Indirectly, the seaweed after suitable processing may be used as a source of alginates which in turn may be used as a constituent of foods or as a source

of artificial silk, leather, rubber, etc. Another interesting feature of seaweed is its sugar content which, under suitable stimulus, can be fermented to give a variety of fermentation products including alcohol, acetone, and acetic acid and a number of valuable chemical products depending on the fermenting agents used. Destructive distillation of seaweed yields volatile oils and tars; the former may be hydrogenated to produce motor fuel. In connection with the use of sea-water resources, whether animal, vegetable or mineral, a far-sighted vigorous policy is required. Such a policy correctly developed would render this country independent of certain essential imports which before the war represented considerable value. Embarkation on a large-scale enterprise should be preceded by well organised and extensive research on a scale compared with which our present efforts would be considered insignificant. It is in this way, and this way only, that South Wales can hope to compete with other regions possessing its advantages.

Education and Research

In considering the operation of a scheme such as the one outlined above, the question will immediately arise: how can it be operated? Will it be operated by private or state enterprise? There are a number of reasons why the scheme cannot be operated entirely by private capital, but private enterprise is essential for its success. The scheme as a whole must be planned nationally, the individual units of the scheme being looked after on a private enterprise basis, the separate entities not being necessarily linked together commercially.

To avoid the stifling influence of bureaucracy which might easily flourish in this atmosphere, private enterprise would be made solely responsible for carrying out its part of the plan and judged entirely by results and progress on the expiration of a suitable period.

An essential part of the scheme would consist of a research institute devoted to research and to development of the various industries, the institute being supported by a compulsory levy and administered by an industrialist, the universities acting in the capacity of advisory bodies. Such an institute would cost £500,000 and employ about 1000 people, and would take about four years to establish on a full-working basis.

Mr. Devereux concludes by saying that the fact that the complete scheme would take many years to fulfil should not exert a deterring influence since, if it was backed financially and the assurance was forthcoming that ultimately the economical aspect would be established, in the intervening period ample work would be found for a large section of the population in constructional work. Process workers for whom employment could not be found immediately could be occupied in public schemes, such as rehousing and road-building schemes.

A CHEMIST'S BOOKSHELF

A TEXTBOOK OF ORGANIC CHEMISTRY. By Dr. Julius Schmidt (fourth English edition, revised and extended, by Dr. H. Gordon Rule). London: Gurney and Jackson. Pp. 923. 28s.

Since Dr. Rule's first translation of Schmidt's textbook appeared in 1926, it has become a standard work on organic chemistry. The present volume, the fourth edition, was in the hands of the printers when Dr. Rule became incapacitated by the illness which took his life, and it fell to Neil Campbell to complete the proof-reading and the index. As Dr. Rule had left behind a most careful and methodical manuscript of the book it can be fairly said that the volume adheres faithfully to his final notes. The work is systematic to the highest degree, no important development of recent years being forgotten. One looks for instance for information on the sulphanilamide drugs and it is there; the same can be said about such subjects as synthetic rubber, plastics, and vitamin K, subjects which are not yet adequately described in every textbook where one would expect to find them mentioned. It would be more than usually unprofitable for a reviewer to attempt to show off his omniscience by trying to find serious omissions or mistakes. It is a comprehensive, tidy, logical textbook, excellent alike for purposes of study and for reference.

Chilean Nitrate

Nationalisation Scheme Mooted

THE Chilean Minister of Finance is to submit to Congress a bill for the utilisation of salpetre deposits by the State. A Reuter message from Santiago says that the bill authorises the exploitation by the State, a national corporation, or national companies, of the deposits belonging to the Government. It also authorises the State to do construction work, acquire, rent and exploit the deposits, and the President of the Republic is empowered to raise necessary loans in Chilean and foreign currency to the value of 250 million pesos. The bill authorises the creation of a Saltpetre Council under the Minister of Finance.

At present only the trading side of the industry is under Government control through the monopoly exercised by the Chilean Nitrate and Iodine Sales Corporation, formed at the beginning of 1934 to centralise and organise the entire sales and profits of the industry. This corporation owns no nitrate properties and holds no shares in nitrate companies. It has a monopoly for thirty-five years from July 1, 1933, of the free export of, and trade in, Chilean nitrate and iodine. A large amount of British capital is invested in the nitrate producing companies.

Health Hazards in Chemical Industry

by JOHN CREEVEY

MANY of the products used fairly commonly in the chemical industry are dangerous to health—a point that all manufacturers who employ chemicals in processing do not yet appear to realise, in spite of the advice offered by factory inspectors and the existence of works regulations aimed at enforcing precautions. The extent of the danger varies according to the precautionary measures that are taken; even the most deadly of products can be handled safely if the precautions are adequate and if the persons concerned in the work are sufficiently conscientious to observe all of them. Nevertheless, there are products occasional contact with which produces no really serious effects, whereas continuous contact with them ultimately leads to self-obvious poisoning. Let it be remembered therefore that a new product may not show any particular hazard for some time, and even when its effects do become noticeable some persons will be more likely to become poisoned than others.

Precautions with New Products

The health damage still done by dusts, gases and poisonous fumes in industry is not negligible, statistics showing that the industrial worker dies some years earlier than the man outside the atmosphere of the works where chemicals are used. Continuous medical examination of employees serves to detect some cases of occupational poisoning, but not all of them—at least not in time to prevent danger to the health of the individual. Good ventilation of buildings where dangerous products are used, and rigidly enforced methods of personal protection and hygiene, help to reduce the number of deaths or cases for health compensation, but still the management of the works and the worker alike must continue to make themselves safety-wise as regards the products which are handled. The use of a new product, or one being used for the first time at a particular works, should receive the immediate attention of the person responsible for safety measures; its hazards under ordinary conditions may be common knowledge, but conditions at the particular works may not entirely meet the needs of safe handling, and the worker must certainly be provided with some measure of knowledge concerning its properties and possible hazards.

The incidence of health hazards in the chemical industry has become more important since the commencement of the war for the reason that the scarcity of materials has had to be met by substitutes; some of these are new and their properties are not yet fully known, while other materials, of common usage in other directions, have found new applications that make a new set of precautions necessary.

Coal-tar benzol and petroleum benzene are both common enough industrial solvents; likewise, toluene and xylene. These three substances are closely related chemically and all of them can produce dangerous effects in concentrations as low as one hundred parts per million parts of air. Yet, whereas one worker may be affected by benzene fumes, it does not follow that he will be seriously affected by toluene and xylene even though exposure is continuous. Chemically, the three are homologues, but their physiological effects upon the worker differ; toluene and xylene do not attack the bone marrow, and after absorption by the body they are oxidised respectively to benzoic acid and toluic acid for bodily disposal, whereas benzene is transformed into phenol and dihydroxybenzene.

When aniline is absorbed through the skin, the power of the blood to absorb oxygen is reduced by formation of methaemoglobin, but the aniline itself is oxidised to para-amidophenol which is only slightly toxic. Both para-nitraniline and para-toluidine are excreted from the body almost unchanged, but the latter compound has been considered the cause of bladder cancer in aniline workers. Curiously enough, in the case of poisoning by dinitrophenol, women workers appear to be less affected than men. From these facts it will be seen that it is never safe to brush aside possible risks which tends to happen if one argues by analogy where closely related products are being considered.

Hydrogen Sulphide

Hydrogen cyanide, normally regarded as dangerous, makes its effects apparent in concentrations of 60 parts per million, hydrogen sulphide, which can be detected at 10 parts, per million, reaches a really serious concentration at 150 parts per million, a dilution two and a half times as great as that mentioned for hydrogen cyanide. The effects are very similar, namely, a sense of oppression in the chest, headache and nausea, and weakness, with eventual paralysis of the respiratory system. Hydrogen sulphide, however, is not immediately fatal, but oedema of the lungs can develop even after four or five days. The one hazard is therefore quite as serious as the other, although the two products responsible are generally considered to be quite different in toxic properties. Incidentally, it may be pointed out that with hydrogen sulphide it is unwise to rely upon the characteristic smell for detection, as

the gas can still be present in dangerous concentration when the smell is not perceptible.

Continuous contact with the poisoning agent is not always the cause of ultimate trouble; no amount of care can be too great when a risk is known to be present. In one case of aniline poisoning the man's face and clothes were merely splashed when he was repacking a faulty cock on an aniline pipeline, but some of the aniline entered his mouth. Due precautions were taken against the effect of direct poisoning, and the man also bathed and changed his clothes, but he omitted to change his clogs, and it was probably from this source as much as elsewhere that the aniline was absorbed by the skin.

Although some process has been in use for ten years or more, and a particular product has been used without ill result over an equally long period, just one slight change in procedure or one safety precaution dispensed with can provide the weak point from which trouble develops eventually. For this reason, any contemplated change should be carefully reviewed, if the material involved is one which is known to be dangerous or if it is a product which is *not* known to be safe under all conditions of use. Where a large number of products are handled, it is probably wise to make a list of all those that are likely to be injurious to the health of the worker, adding a description of their uses in the works, toxicological properties, and the symptoms by which ill-effects can be recognised. Such a list, in the hands of each departmental manager or foreman, will make him more familiar with risks likely to arise.

Unnecessary spillage, and the mere dumping of "empty" containers in unsuitable positions, often gives cause for health hazards if the product is the least poisonous; an accidental spillage must be cleared up without delay, and all traces removed, if necessary by washing down with water or in other suitable ways, but even in the mere act of clearing up and cleansing some supervision appears to be necessary—the dust of a dry product can be carried by air currents when a shovel is carelessly used, and there are products which evolve poisonous fumes when in contact with moisture.

Industrial poisons can enter the human body by three routes—through the mouth and the gastro-intestinal tract; through the nose and mouth in breathing and so to the respiratory tract; and through the skin. Where entry is through the skin no part of the body is immune, though some parts are less subject to absorption or penetration than others. To these must be added, separately for emphasis, the fact that there is ready access through any open wound, scratch or abrasion of the skin which has not been properly dressed and given protection. The ease with which a particular poison enters the body varies—the man may be more than normally susceptible; the temperature in the place of working or the exertions of the man may open the pores of the skin more widely to admit poison even though simultaneously there is also a more rapid expulsion by perspiration; some poisons are more easily absorbed before a meal and some take effect sooner if the man is a heavy eater or a heavy drinker, though a man who does not take enough moisture into his system is not so ready to expel such small amounts of poison as have been absorbed.

Among products commonly handled, which cause poisoning by entry through the skin, are nitrobenzene, aniline, trinitrotoluene, picric acid, phenol, diamines, mercury compounds, methyl alcohol, carbon disulphide, benzol, tetraethyl lead (absorbed very rapidly and in dangerous amounts), strong mineral acids (absorbed as distinct from serious burning), and cyanides. Ignorance in the matter of what is and what is not dangerous is sometimes astounding; for instance, a case of picric acid poisoning occurred through negligence merely because the man had once been the victim of burns and had been treated with picric acid dressings which led him to think that the present circumstances of splashing did not warrant any treatment until the end of the shift when he would sooner or later be washing.

Industrial Safety Gleanings

Handling "Empty" Containers : Protecting Workers' Skin

THE hazards which attend the handling of a metal drum carrying some liquid chemical product are often greatly increased when the drum becomes "empty." If the drum has carried an inflammable liquid, the vapour from the small residue mixes with the air in the otherwise empty drum to give an explosive mixture; if the contents have been some corrosive product, it is likely that the small residue will attack the metal of which the drum is made, with evolution of hydrogen gas which also forms an explosive mixture with the air in the drum. The trouble comes when the drum is being inspected, or cleaned and reconditioned.

Whenever it is necessary to inspect the interior of "empty" metal drums, either before or after cleaning, it is advisable to use a low-voltage vapour-proof electric lamp with ample length of extension lead, and the

frame of the lamp should be earthed. As a fundamental axiom of safety, never use an unprotected electric bulb, and certainly not any form of naked light; the breaking of the bulb or arcing at the socket can easily ignite any mixture of inflammable vapour and air inside the drum. The earthing of the frame of the lamp is very advisable, because serious electric shock has been more frequent than might be anticipated.

When an " empty " drum needs reconditioning by welding, this work must never be done until the drum has been cleaned, and even then—after thorough cleaning—there is still a hazard attending the application of heat, for there may be pockets of inflammable liquid in the chime joints which have not been removed in the cleaning process. Here the observance of certain precautions in the course of welding will avoid accidents. First, test the air for inflammability by holding the lighted torch at the bung holes in the end and the side of the drum, where any sign of firing shows the need for further cleaning before application of heat. Secondly, when welding it is best to stand alongside the drum as near as convenient to the centre, and not at either end, for the reason that the end seams are generally not so strong as the side seams and an explosion will invariably blow out one of the ends of the drum rather than rupture the side. Thirdly, with the last-mentioned fact borne in mind, it is well to carry out the repair work in some situation where the danger of a blown-out end will not injure persons passing. Fourthly, do not expose any part of the body unnecessarily to weak points in the construction of the drum, and certainly do not reach across the ends of the drum with the full length of arm, but turn the drum on its axis to bring repair points within easy reach.

Thorough Cleaning

In the cleaning operation, drums must first be thoroughly drained and then washed out, the washing medium being varied to suit the nature of the liquid which the drum has previously held; sometimes a neutralising agent may be needed, and perhaps steaming of the interior. Mechanical abrasion of the interior may be necessary to dispose of corrosion or deposits, which mere washing will not remove; in this case, if the drum has held an inflammable solvent it is advisable to use an abrasive which is not spark-producing, even when there is sufficient water present to avoid any sparks that might be otherwise caused by abrasive material in dry condition.

It is the responsibility of the user to see that " empty " drums are drained and have their bungs screwed home securely before they are handed over to the transport concern; the danger of an acid burn to persons unfamiliar with the nature of acids cannot be too highly emphasised where there is no protection afforded by acid-proof clothing, and it is equally true that the dangers of an " empty " container which has a residue of inflammable vapour are greatly increased in the hands of transport employees who are not familiar with this class of traffic. Glass carboys which have carried acid or other corrosive liquid need particular care in the matter of draining and labelling with a " warning label " before being consigned.

Industrial Dermatitis

A committee on the recognition and prevention of industrial dermatitis has reported its findings to the American Medical Association (*J. Amer. Med. Ass.*, 1943, *122*, 370). After classifying primary skin irritants and laying down certain criteria for diagnosis, the report makes recommendations in regard to protective measures. Nine protective hand creams and cleansers are mentioned. The simplest formula consists of 70 per cent. soft paraffin, with 30 per cent. hydrogenated cottonseed oil. Modifications contain 5 per cent. commercial sodium silicate solution, and, in some formulæ, glyceryl monostearate, with white wax, hydrous wool fat and soft paraffin to form the basis. A non-greasy preparation which will dry on the skin and is not easily removed is provided by: ethyl cellulose 5, mastic 8, castor oil 1, acetone 86 per cent. Most of the formulæ for cleansing agents contain sulphonated oils from 45 to 70 per cent., with light liquid paraffin, and a 25 per cent. aqueous solution of gelatin 10 per cent. The addition to some formulæ of latex is recommended in order to give more efficient protection. The possibility of using inert powders to protect against the mechanical irritation of abrasives is also mentioned and the following formula quoted: zinc oxide 5, talc 5, iron oxide 1, Irish moss 2, gum benzoin 2, water 16, alcohol 15, vanishing cream 60 per cent. Where masks or respirators are worn, a wool fat cream or a tragacanth and borax application is advised, to minimise possible irritating effects of the mask.

The technique of welding stainless steels does not differ greatly from that used with ordinary steel, but the problem of choosing the right arc welding electrode is sometimes confusing because of the many different varieties of this type of steel now used in industry. A brochure, " Welding Stainless Steels," produced by MUREX WELDING PROCESSES, LTD., Waltham Cross, Herts., gives considerable help in overcoming this difficulty as it contains a table in which various branded steels produced by nine well-known steel makers are classified according to the type of Murex electrode recommended.

The Chemist in the Civil Service

The Need for Higher Status

(From a Correspondent)

THE Civil Service is always an easy target for the barbed wit of the satirist, and particularly so in its present state when, owing to the war, it is swollen to many times its normal size. Naturally enough, then, a number of articles and books have been written to demonstrate the futility and obsolescence of the Service. It is usual to comment on the clerical and administrative sides, and little has been said of the technical branches. Some statement of the present state of affairs in the Service, as it affects chemists, may help to clear away misunderstandings, and, in the writer's view, may help to counter many of the criticisms, which are offered by not disinterested persons, against Government enterprises in general. Those with axes to grind often attribute the wastage and inefficiency of Government chemical establishments to the "red tape" and refusal to take responsibility, which, it is said, characterise the Civil Service. The writer is of the opinion that the "growing pains" experienced in, for example, the Royal Ordnance Factories, are not inherent in the structure of the Service, but are partly inevitable, owing to dilution of experienced staff, and, for the rest, may be traced to the incompatibility of the Civil Service system of administration and execution with the methods and outlook of temporary executives who have been trained in different spheres. Under the circumstances, it is felt that chemists employed by the Government have done a remarkably efficient job both in production and research, and, if, hereafter, some difficulties and problems are mentioned, it must be understood that they do not alter the truth of this statement.

War and Peace

In pre-war days, the number of chemists employed by the Government was not large. There were relatively few Government-controlled factories and even at these production was not maximal. Nor was the Government contribution to chemical research much more extensive, although qualitatively most significant—*e.g.*, the Food Investigation Board, National Chemical Laboratory, and the Research Department, Woolwich. There were also the Research Associations, which, however, were not wholly dependent on Government finance, and were influenced more by the particular industry with which they were associated. There were, too, a number of chemists employed in non-chemical departments, *e.g.*, the Royal Aircraft Establishment. The Admiralty, also, maintained a completely separate chemical staff, both for research and production.

When the achievements of Government chemical staffs in pre-war years are surveyed, the list is impressive, containing, as it does the work on fruit and meat preservation done by the F.I.B.; the work on explosives by the R.D. (Woolwich) which paved the way to our bigger and more beautiful bombs; and, not least, the creation of that nucleus of trained personnel which was to play such a vital part under the conditions of war. The prime concern of the Civil Servant, is with public, not private or sectional, interest; he is less disposed to pander to considerations of immediate profit, at the expense of the ultimate welfare of the State. One can justly claim, therefore, that the tradition of the peace-time Civil Service, particularly in its technical branches, is, to put it mildly, not a disadvantage when tackling the grimmer problems of war.

Ordnance Factories

The most startling war-time development in Government chemical enterprise is the creation of a large number of giant factories employed in munition production—explosives, iron and steel, shell- and bomb-filling, etc.—an account of the development of which would be a history in itself. Starting relatively late, in most cases in 1940-41, so effectively have they worked latterly that by the summer of 1942 there was apparently a surplus of explosives, guns, bombs and shells. Since that time much labour has been transferred from these factories to tank and aeroplane manufacture. In peace-time, R.O.F.'s exist largely as controls to maintain the price of munitions within reasonable limits and prevent the exploitation of the State by private interests. Their transformation into the pacemakers of munitions production cannot be fully told here.

Other Government chemical departments have undergone similar expansion, based on the framework provided by the peace-time organisation as a framework. The war has seen a considerable decentralisation of research which formerly was concentrated in places like Woolwich. Many "extramural" research laboratories, university and college laboratories for the most part, are now co-ordinated into the Government organisation. Analytical control of production processes must necessarily increase as the volume of production rises. The Inspection

Departments have therefore expanded probably more than any others. Again, the Admiralty maintains a separate Inspectorate of Naval Ordnance, distinct from the Chemical Inspection Department of the Ministry of Supply. The latter has had enormous difficulties in obtaining and training staff, but again wonders of improvisation have been achieved.

Administration

Surveying the scope of chemistry in the Government service leads to the question of its significance for the ordinary chemist, and the question of administration and conditions of working, relative to private industry and to academic spheres. The MacDonnell Commission of 1912-14 centralised authority over all Civil Service Departments in the hands of the Establishments Division of the Treasury. So, as far as finance and administration are concerned, the scientist in the Service has always, in the long run, to convince the Establishment Officer, if he desires any but the most trifling concession or facility. To quote the words of a civil servant of long experience: "The Establishment Officers are not scientists and live in a non-scientific atmosphere, and are therefore indifferent if not hostile to the advancement of physicists and chemists in the service. They certainly do not understand their needs and the importance of their work." Furthermore, it has been said, with a not undue amount of cynicism, that a junior scientist's only hope of promotion in the service is to get some clerical work to do, become a "committee man," surround himself with subordinates, however humble their grade, and then, being able to claim administrative responsibilities, apply for higher grading.

The work of the administrative class has been defined as being "concerned with the formation of policy, with the revision of existing practice or current regulations and decisions, and with the organisation and direction of the business of Government." A contented staff is the first essential for efficiency, and this is as true of scientific as of other staffs. Scientists naturally prefer an administration that has basically the same outlook as themselves, one which looks to final results as the justification for all procedure, rather than to fine interpretation of detailed regulations. It must be said that the administrative side often tends to apply the letter rather than the spirit of the law, and so there arise conflicts between technical and administration staff. This may lead to an accumulation of small grievances due to the difference of outlook, matters that could easily be settled but so often result in the destruction of goodwill in the department or laboratory. Too often the scientist feels that his value is measured only by the number of hours he works, provided they start and end at the specified time, something which is easily comprehended and measured by the administrative mind. He feels also that his actual achievements are all too rarely appraised by higher authority. The administrative posts should be freely open to scientists and the inferior status of technical staffs removed. In view of the important reaction of science on all spheres of modern life, and the opportunity offered by administrative posts for exerting a directing influence on public affairs and for aiding the proper application of science to the national well-being, it is essential that appropriate administrative posts should be filled by persons with scientific training, and a scientific degree should be equivalent to one in the classics as preliminary qualification for such a post.

Certain administrative posts can only be filled adequately by men of high scientific attainments. Of course, it does not follow that a successful scientist is an equally good administrator, but he can often prove himself to be such, given the opportunity. Last month Viscount Samuel stated the problem well in the House of Lords when he spoke in the debate on scientific research. In his speech he said: "No one urges that high scientific attainments are in themselves a qualification for administrative posts, but at all events, they ought not to be regarded as a disqualification, as is sometimes now found to be the case." Scientists engaged in research have little or no opportunity to transfer to the administrative branches, whereas it would obviously be profitable to allow scientists with a bent for administration to transfer to posts where their intimate knowledge of research would be of great assistance to their colleagues who remain at the bench. At present such transfers would imply promotion from a lower to a higher hierarchy, but there is no reason why this should be so, given equivalent remuneration. The latter condition would ensure that technical staff were not drawn to administration merely by the prospect of higher salaries, to the possible ultimate disadvantage of science.

Remuneration

The vast expansion of scientific staffs due to the war has thrown into relief the absurdity of rigid complements for various grades of staff. These complements are used as excuses for not promoting suitable people, it being said that the complement of the higher grade is already filled. In some branches of the Civil Service, it is possible to estimate accurately the numbers and grades of staff required to cope with a certain volume of work. This is little short of fantastic in scientific branches even in

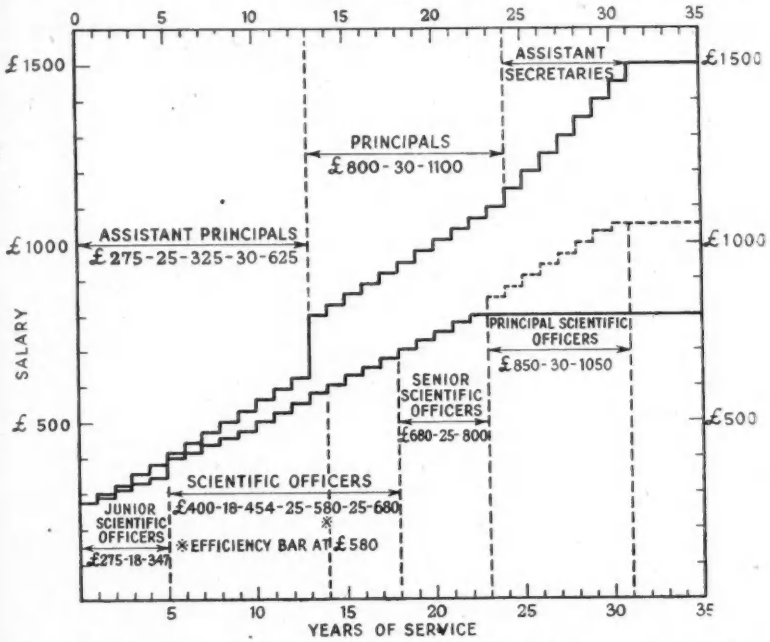


Chart showing the contrasting rates of pay of administrative and scientific officers in the Civil Service.

normal times, except in so far as it enables posts to be filled at minimum expense.

In 1931 the Government accepted the principle put forward by the Royal Commission on the Civil Service, that salaries of civil servants should reflect the long-term trends of wages in outside industry. This was a direct departure from previous policy, that the Government should always be among the "first flight of good employers." This reversal of policy, coupled with the separation of the Civil Service Unions from the rest of the Trade Union Movement by the 1927 Trades Disputes Act, has gravely handicapped civil servants in efforts to maintain or improve the general salary level. Scientific workers in the Civil Service are only a small part of the whole, and they have suffered in correspondingly large measure, till to-day it is true to say that if the original aim of the Government had been to get its scientists as cheaply as possible, the position which would have eventuated would not have been much different from that which exists to-day.

The inferior status of scientists in the service is most easily shown by a comparison of the prospects of remuneration for a scientist and an administrator, both requiring honours degrees on recruitment. From the accompanying chart it can be seen that for the first thirteen years salaries run parallel, but after that point, there is a marked divergence. The administrator reaches £800 by one promotion at the end of 13 years' service—actually, many assistant principals are promoted earlier—whereas the scientific officer reaches the same figure only after 22 years, and provided he has received two promotions and passed an efficiency bar. The administrator reaches £1100 after 24 years, the scientific officer £1050 after 30 years' service, by which time the administrator has reached £1400. The actual state of affairs is, however, even worse than this. The scientist's chance of reaching the position of principal scientific officer is so uncertain that the line on the chart is dotted to indicate this.

Comparison of salaries of scientists in private industry and in Government service is difficult at the present time, owing to the greatly enhanced position of the former. On a long-term view, the scientist in private industry can attain to positions of greater importance and responsibility than in the Civil Service. Managerial and directing positions are open to scientists in private

firms, and they can also play a part in guiding policy. On the other hand, the Civil Service does not give such freedom to the research worker as is available in a university, and so comparison with the academic life is equally difficult. Assistants to qualified staff in the service are exceedingly badly paid, and their position has not been improved by the upgrading of the different classes so that a laboratory assistant who was formerly only required to have a general education, is now required to have at least a matriculation certificate, if not an Inter.B.Sc. For an Assistant III, the former recruiting requirements were Inter.-B.Sc. or equivalent, whereas latterly B.Sc.s, even those with first-class or second-class honours, have been recruited to the Assistant III grade by the score. The A.Sc.W. and I.P.C.S. are together making strong representations to get these individuals upgraded to their correct posts, which is particularly necessary just now, owing to the shortage of qualified scientists.

Secrecy

Recently, the charge has been commonly made that secrecy in Government science is a cloak to inefficiency. Much of this criticism is badly misplaced. Remembering that prior to the war, and even more so during the war, a very large part of Government science has been connected with the needs of the Services, it can readily be seen that such work by its very nature needs to be kept secret. In fact, the staffs concerned can be congratulated on the way in which they have preserved the facts about our weapons and research from the enemy. The superiority of our radiolocation is one proof of this, and scientists with "inside knowledge" could, from personal experience, multiply this instance many times. But this does not altogether answer the criticism. One should bear in mind, however, that it is generally accepted that the very essence of private industrial firms is competition, and it is the rule, rather than the exception, for two different laboratories to be tackling the same problem in complete isolation from each other. The hampering of the war effort by the maintenance of "trade secrets" has often been demonstrated. In the Government service, it is certainly true that more co-operation between different sections could easily be organised. At the present time, it is possible, although often very difficult, for a scientist to find out where work connected with his own problem is proceeding, and to obtain the fullest contact with the workers concerned. Some exertion will be necessary to do so, and the displeasure of some superiors may have to be incurred. The facilities offered by the D.S.I.R., etc., are not well enough publicised to scientists, but this applies equally to those in private industry as to those in the Civil Service. Also involved in the question of secrecy is the restriction on publication of scientific papers about work done for the Government. At one time publication was practically the only way of establishing one's reputation as a scientist. It is still the main means whereby academic scientists seek to achieve recognition and to appraise scientific work, and someone seeking eminence in such circles would find greater opportunities in a university career than in Government service. But with the great expansion of scientific work outside universities in the last 20 years, publication has ceased to be the only method of appraising a man's work. Obviously, some work done for the Government must remain unpublished, but it is of first importance that an enlightened policy should be followed in this respect; publication should not be taken as the only index of a man's worth, and all work, whether published or not, should be aken into account.

Outside Contacts

For vital progress in this work Government scientists should be given every opportunity of making contact with workers in the same fields in private industry and the universities. A radical change of outlook is necessary to enable this to be done. After the war, the policy of allowing civil service scientists to go for a short time to work in another Government department, research association, industrial or university laboratory should be investigated and carried out as far as possible. Visits to other countries might also be considered. The Government introduced the Federated Superannuation Scheme of the universities as the method of pensions for its scientific staffs to enable scientists to interchange between the Service, the universities, and private industry, but before the war this was not carried out to any great extent, to the detriment of Government science. A reasonably mobile staff brings a broader and fresher outlook to bear on its problems. The influx of wartime temporaries has had this effect and the advantages it brings must not be lost in the future.

After the war the reconstruction will need the services of many skilled scientific workers both for the rebuilding of Britain and for assisting in relieving the distress throughout Europe. The primary responsibility will lie with the scientists in Government employ rather than with those in private industry. We have available first-class scientists and we must ensure that the organisation will be present that will utilise their services to the best advantage of the victorious democratic nations and of the liberated peoples of the world.

Melamine Resin for Paper*

The Improvement of Wet Strength

by RALPH W. KUMLER

"WET strength" is a term that has been much used in paper-making circles recently and there may be some confusion as to exactly what is meant by it. In the ordinary sense it refers to the strength of paper after soaking it in water until the maximum effect of the water has been realised. Hard-sized paper when dipped in water for a few minutes will nautrally have greater strength than an unsized paper comparable in other respects. However, this is a matter entirely apart from true wet strength. The soaking should be sufficiently prolonged for the effect of sizing materials to be overcome. A highly absorbent paper may have greater strength than a well-sized sheet after both have been thoroughly wetted.

Until about a year ago, wet strength was secured by the use of glue and formaldehyde, locust-bean gum, or urea-formaldehyde resins It has been customary to apply these materials to the pre-formed paper web either at the size tub or in other surface-application equipment. Being water-soluble, they were not retained by the fibres if added to the stock before forming. This limited the use of such materials to paper plants possessing the proper equipment, besides placing an extra burden on the drying capacity. More recently a new resin has been developed from melamine and formaldehyde which has such an affinity for cellulose fibres that it can be mixed with them before the formation of the sheet and yet be well retained when the white water is drained off. Retention averages 60 to 80 per cent. of the amount of resin employed, varying with the percentage of white water running to waste, the degree of hydration, the age of the resin solution, the amount of resin added, the point of addition, and perhaps other factors not yet completely evaluated.

Dissolved in Acid

In its commercial form, the melamine resin used for the purpose is a white powder sparingly soluble in pure water but readily soluble in dilute solutions of certain acids. When added to stock dissolved in pure water, it exhibits no affinity for fibres and is mostly lost when the water is drained away. When dissolved in one of several dilute acids, particularly muriatic, and aged a short time (3 hours or more), retention by the fibres is high. The muriatic acid remains in the water rather than with the fibres. After preparation and aging of the acid resin solution, it is satisfactory for use for several days although it reaches its peak efficiency in about 16 hours. Eventually it becomes viscous and finally gels, after which it is unfit for use. The rate at which it proceeds to the gel stage is governed by the proportion of acid to resin, and by temperature, as well as by certain chemicals. None of the chemicals ordinarily employed in the manufacture of paper appears to affect the degree of wet strength produced by the resin. They must, however, be added to the stock separately and should not be mixed with the resin solution.

Heat Curing

All types of paper-making fibre respond to treatment with the acid melamine resin. The degree of hydration, however, has an important bearing on the amount of resin retained by the fibres, and on the degree of wet strength produced by the resin retained. Much better results are obtained with well-beaten fibres. Also, higher wet strength is secured if the resin is added to the stock after all mechanical work on the fibres has been completed. This usually means feeding the solution in a continuous stream at a point near the forming part of the machine. It is customary to use 0.5 to 3 per cent. of the resin based on the dry weight of fibre. As the amount of resin employed is increased above 3 per cent. the percentage of the amount used retained rapidly declines, no increase in retention being noted if more than 5 per cent. is used. The resin must be cured by heat after incorporation into the sheet. In many cases, the heat of the paper-machine dryers is sufficient to produce a complete cure as the paper leaves the machine. In other instances, cure is complete only after several days storage of the paper. Naturally, the reaction proceeds faster in the roll or sheet pile if the initial temperature is somewhat elevated. The acid melamine resin incorporated in the stock does more than impart wet strength. The dry bursting and tensile strengths are markedly increased, and the folding endurance is improved. Water resistance of rosin- or wax-sized papers is enhanced moderately but the absorbency of water-leaf papers is scarcely affected. Accelerated aging tests confirm that the effects of the resin are permanent under conditions of high temperature and humidity.

Careful tests for toxicity of paper treated with melamine resin have been conducted, as well as dermatitis tests. Results indicate that such paper may be safely allowed to contact foodstuffs or the human skin. Melamine paper resins are being used mainly for three purposes: (1) Papers for packaging moist materials or for dry materials where the packages will be exposed to water; (2) Blueprint papers

* From a paper presented last June to the American Pulp and Paper Mill Superintendents' Association, New York.

and papers for booklets, maps, etc., which may be carried outdoors; and (3) Paper towels and lens tissue which should not deposit fibres when used for drying the skin or polishing optical glass.

An interesting test has just been conducted on the resistance of multi-wall bags to rough handling in wet condition. About 9000 bags of eight different types of construction were filled with 50 lb. each of tri-sodium phosphate. Types included single multi-wall bags with one outer ply of wet-strength paper, and double multi-wall bags with eight plies of wet-strength paper. Some of each type of bag were kept dry, some were submerged in water for 24 hours, some again were exposed to rain for eight hours and then to a spray of water for 24 hours. Final data were not complete at the time of writing, but results indicate that the capacity of the bags to resist such handling is roughly proportional to the number of wet-strength plies included in the construction.

Ammonium Nitrate as Fertiliser

"Timidity" Prejudices its Use

THE prejudice against ammonium nitrate as a fertiliser was discussed at the recent meeting of the American National Fertiliser Association. Dr. F. W. Parker, head of the Division of Soil and Fertiliser Investigations, Department of Agriculture, said that since this material was the only nitrogen compound usable as both an explosive and a fertiliser, fertiliser manufacturers were unjustifiably timid about it. The principal problem with ammonium nitrate was to prevent caking of its small crystals in storage. Granulation largely prevented this objectionable property of fine crystals and additions of small percentages of kaolin, diatomaceous earth, or other conditioning agents practically prevented caking of granules. Small amounts of paraffin in addition to an anti-caking agent were also useful in reducing hygroscopicity. Addition of ammonium nitrate to mixed fertilisers affected their hygroscopic properties but was not alone responsible. Other constituents, notably sodium nitrate, urea, and manure salts, also contributed to the hygroscopicity of the product. He urged use of ammonium nitrate to provide up to two units of nitrogen in mixtures containing little, if any, other hygroscopic compounds.

Mr. Arthur M. Smith, of Synthetic Nitrogen Products Corporation, said the problem was now acute, although it was not new. Ammonium nitrate was used in mixed fertilisers as early as 1924, and before the war cut off imports it was mixed in quantities as high as 39,000 tons annually in "Cal-Nitro."

New Control Orders

Export of Fatty Alcohols, Driers, etc.

IN accordance with the Export of Goods (Control) (No. 7) Order, 1943 (S. R. & O. 1943, No. 1116), which comes into force on August 30, licences will, in future, be required to export the following fatty alcohols, including sulphated (sulphonated) fatty alcohols, to all destinations: cetyl alcohol; lauryl alcohol; oleyl alcohol; stearyl alcohol; and mixtures consisting wholly or mainly of one or more of the above; also bile acids and their salts; cyclohexanol; cyclohexanone; driers in oil or other medium, whether in paste or liquid form; jointing compositions containing lead compounds; pigments in oil or other medium, whether in paste or liquid form; saponin (quillaic acid); and trypsin.

Silver, in the same Order, has been added to the list of controlled non-ferrous metals and alloys.

TANK LININGS OF SYNTHETIC RUBBER

A new method of bonding sheets of Koroseal directly to the welded steel, wood, or concrete of tanks enables the application of tank linings to be extended into fields which natural rubber cannot handle because of physical limitations. The technique has been developed by the B. F. Goodrich Co. Its principal advantage for tank linings is the remarkable corrosion-resistance possessed by Koroseal, because of its inertness towards strong corrosives such as chromic and nitric acids, which have a deteriorating effect on natural rubber. The new linings, made in sheets, are three times thicker than an earlier type which employed fabric backing, and this increase in thickness makes them better able to withsand physical damage. However, the material has limitations both in temperature ranges and the effects of various chemicals upon it.

GREEK NICKEL AND CHROME

Reports indicate that the principal metals now being produced in Greece are nickel and chrome. Monthly production of nickel mines at Atalante and Karditsa amount to 3000 tons of ore with 2½ per cent. nickel content, and output of the mine at Larimne is about 2000 tons; all the nickel mined is shipped to Italy. Chrome-ore output is concentrated by a representative of the Krupp works for shipment to Germany. The price paid by Germany for chrome is said to have risen from 80 RM. a ton in September, 1941, to from 300 to 400 RM. a ton in August, 1942. Lead and zinc production has been discontinued at the Laurion mines and old stocks have been sent to Italy. Bauxite mines near Amphissa are reported to produce about 3000 tons a month.

Antoine Lavoisier

The Founder of Modern Chemistry

ON August 26, two centuries ago, Antoine-Laurent Lavoisier was born in Paris. Before his life was brought to its premature end by the guillotine he had demolished that great obstacle to chemical progress, the phlogiston theory, and had laid the foundations of modern chemistry. One might have expected Lavoisier to choose the law as his profession, for his father was sheriff of the Court of Justice; indeed, the young man did go so far as to study law and gain his licence to practise. He had already learnt some science at the College Mazarin, but the turning-point of his career seems to have been his attendance at some chemical lectures given by Rouelle at the Jardin du Roi. These lectures, with their spectacular and evil-smelling experiments, were as attractive to the élite of Paris as in the next century the lectures at the Royal Institution were to a select London audience. Inspired by Rouelle's demonstrations, Lavoisier started scientific inquiries of his own, first into meteorology and then into geology. He started investigating the rocks and minerals in the country around Paris, and this work led to his first paper to the Academy of Sciences, in which he gave the true explanation of how plaster-of-Paris "sets" by the addition of water and the formation of gypsum crystals. His reasoning was based on the results of careful weighings which enabled him to demonstrate that when gypsum was heated it gave off part of its water of crystallisation, and that this loss in weight was equal to the weight of water absorbed when the plaster-of-Paris hardened. In 1769, he became the youngest member of the Academy of Sciences, which four years before had awarded him a gold medal for the system of street lighting he designed for Paris.

An Unpopular Move

It was Lavoisier's scientific ambitions that led him to join the Farmer-General's department, which collected taxes on behalf of the King of France. He bought a share in this most unpopular organisation in order to provide himself with the money he wanted to expand his laboratories, to hire his assistants and to develop a corps of scientific correspondents. However much his colleagues in the Academy of Sciences may have regretted his connection with the French system of tax extortion, it did enable him to carry out comparatively elaborate experiments which played a vital part in the furtherance of chemical science.

At that time there were few chemists who had any doubts about the validity of the phlogiston theory. According to this theory, combustion had to be explained by believing that combustible substances burn because they contain a material principle called phlogiston. It was supposed that when a piece of coal or wood burnt it parted with its phlogiston. The calcination of substances like lead and mercury was similarly explained, a metal being imagined as a compound of calx (in modern nomenclature, metallic oxide) and phlogiston. The idea received the support of scientists all over Europe; in England, Priestley and Cavendish both supported it, though Boyle held the contrary view that metals were simple elements and not compounds. As long ago as the 16th century, however, it had been noted that when metals were calcined they gained in weight, which was inexplicable on the phlogiston theory—unless phlogiston had negative weight! The point that metals gained weight when heated was proved by Boyle, Rey, and Sulzbach.

New Combustion Theory

Lavoisier repeated their experiments, using mercury as the metal, and was able to show that calcination was a process in which an elementary substance combined with the gaseous element which he called oxygen, in the mistaken belief that it was an essential constituent of all acids. In formulating the new theory of combustion, which Lavoisier later extended to explain animal respiration, he derived the full benefit of the recent isolation of oxygen and the recognition that air was a mixture of gases, of which oxygen was one (both facts were discovered by Priestley) and Cavendish's discovery that water was a compound of oxygen and hydrogen. Lavoisier's ideas proved attractive to the French chemists Berthollet, Fourcroy, and Guyton de Morveau, and were accepted in Britain by Joseph Black, of Edinburgh; his theory was introduced into Germany by Klaproth.

Lavoisier's experiments led him to develop the Law of the Conservation of Matter, which he expressed in the words "Rien ne se perd; rien ne se crée." Throughout his researches Lavoisier used the balance with such success that thenceforward it was looked upon as the essential instrument of chemical work. As Sir Edward Thorpe wrote: "No one before him so clearly foreshadowed the doctrine of the indestructibility of matter, and it was mainly through his teaching that the balance came to be recognised as indispensable in the pursuit of chemistry."

Lavoisier's worth as a man of science was early recognised by the authorities, which appointed him a commissioner of the Régie

des Poudres, the organisation responsible for supplying the saltpetre which the Army needed for making gunpowder. He effected many improvements in the manufacture and refining of saltpetre, and in 1791 he became secretary of the famous Commission for Weights and Measures, which did so much to develop the metric system. He helped to formulate the nomenclature of this system of measurement now used by scientists everywhere; in particular he was concerned with establishing the unit of mass.

Work for Agriculture

His work for the Farmer-General's department led to his becoming interested in agriculture. Seeing that farming could be much improved by the application of scientific method he bought Fréchines, at Villefranœur, near Blois. In one of the two chateaux on this estate he installed a chemical laboratory, and he introduced many agricultural novelties to the peasant farmers of the district. He was among the first to plant potatoes in France, and by obtaining improved seed he was able to double the wheat yield on his farm. With the peasants he appears to have been most popular, for not only did he help them to improve their crops but he also protected them against the rapacity of the local representative of the Farmer-General's department.

As the Revolution developed, Lavoisier found himself compromised in the eyes of the revolutionaries through his association with the Ferme Générale. His execution, if he stayed in France, was inevitable, but his patriotism decided him against leaving the country. He continued his experiments, mainly in his Paris laboratory at the Little Arsenal in the Rue de la Cerisaie, near the Bastille, and he wrote up his chemical theories into a book which was published with the title "Traite Elémentaire de Chimie," a work best described as the first text-book on modern chemistry. Lavoisier's arrest followed a decree of the National Assembly denouncing a number of officials of the Ferme Générale. He was arrested in his laboratory, and in his only plea to the president of the revolutionary tribunal, Coffinhal, he asked for a little more time to complete an experiment he was making. He was condemned to death, the president (who was himself later guillotined) making the contemptuous remark "La République n'a pas besoin de savants." How much need France later had for scientists may be judged from the fact that Napoleon appointed Berthollet as one of his advisers! Lavoisier died by the guillotine, and his body was thrown into an unmarked grave in the cemetery of the Madeleine. As one witness of the execution said afterwards: "It took but a moment to strike off his head; a hundred years may not suffice to produce another like it."

Memorials of Lavoisier

The name of Lavoisier will never be forgotten by the world of science. In Paris the equipment of his laboratory is preserved in the Conservatoire des Arts et Métiers; his statue stands in the Place de la Madeleine, not far from the Boulevard de la Madeleine, where he lived at No. 17. A street, which runs into the Boulevard Malesherbes near its junction with the Boulevard Haussmann, is named after him. This autumn his bicentenary will be celebrated by a Royal Society lecture, to be delivered by Sir Harold Hartley.

Chemicals in Latin America

A Summary of Recent Expansion

JUST as the last war gave final impetus to the development of a great chemical producing industry in the U.S., this second world war is bringing stimulation and rapid expansion to chemical production in many of the twenty-one Western Hemisphere republics south of the Rio Grande. In the State of São Paulo, Brazil, for example, more than 100 chemical and pharmaceutical products are now being produced. Many are new and others have undergone recent expansion. Mexico is producing sulphuric and hydrochloric acids and a variety of other chemicals. Cuba has substantially increased industrial alcohol output. Argentina is considering plants to produce power alcohol from grain crops and wood by-products. Chile is making more ichthyol from schist deposits. Peru plans more extensive production of caustic soda and chlorine.

Among Brazilian chemical products are sulphuric acid, nitric acid, sodium bisulphite, and sodium bicarbonate. Tanning in that country has profited by the manufacture of chromium salts from domestic ore, providing the basis for chrome tanned leathers. Output of aluminium sulphate in Brazil has been stepped up to between 500 and 600 tons a month, about double the pre-war output. Production of caustic soda is planned to supply expanded production in Brazil of synthetic fibre, dye, soap and the paper industries.

Mexican Production

In Mexico, sulphuric acid is being produced in substantial amounts from smelter gases of a plant in Northern Coahuila. Another plant is producing acid from sulphur by the contact process at San Luis Potosi where

there are sulphur deposits and new plant for sulphuric acid has been started. A dynamite plant is making its own nitric acid. Mexican arsenic is being converted into insectides, while a plastics plant is planned in Monterey.

In Central America

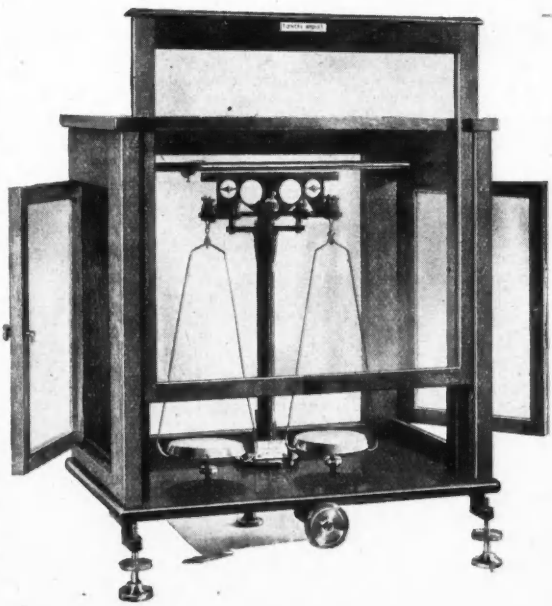
To supply its textile mills, soap plants and a glass factory, Venezuela is working its own sodium carbonate deposits at Lake Orao. The plants need about 1200 tons of sodium bicarbonate monthly. A new chemical plant in El Salvador has been producing sulphuric acid in quantities sufficient to supply all local needs as well as demands from Honduras and Nicaragua. It is used in these countries primarily for pharmaceuticals, alcohol, tanneries, mining, and hat manufacture. The May production of industrial alcohol in Cuba is estimated to have been 8,000,000 litres, not including cane brandy for beverages (compared with a monthly average of 1,350,000 litres in 1942). About 5,400,000 litres of this was intended for motor fuel.

A distillery to make alcohol from cereals and potatoes is being considered by Argentine interests, and other interests are contemplating a plant for producing industrial alchohol from wood waste, sawdust, and wood pulp. The Argentine casein industry is also being expanded. In Peru, caustic soda and chlorine production are expanding and there are high production rates in ethyl alcohol, magnesium sulphate, carbon dioxide, oxygen, sulphuric acid, sodium chloride, calcium carbide, acetylene, propane gas, benzene, and ethyl chloride. New developments include the production of white arsenic and copper sulphate. In Chile, ichthyol is being made in increasing quantities at Santiago and Valparaiso, from the schist deposits of the province of Aconcagua. The product is reported to be similar to the ichthyol formerly obtained from Austria.

A New Towers Balance

Accuracy with Simplicity

A NEW analytical balance—Model 55—is being marketed by J. W. Towers & Co., Ltd., of Widnes. It is constructed on similar lines to the firm's well-known Model 75, and is intended for those who require a moderately priced instrument (it costs £17 10s.) with a high degree of accuracy with robust and simple general construction for routine work. It is ideally suited for use in technical colleges. Production costs have been reduced by fitting a single fall-away parallel arrestment. It has a capacity of 200 grams in each pan, the pans being of Monel metal, 3 in. in diameter, and with Monel wires (4¾ in. between the wires at the base, and 8¼ in. high). The sensitivity is 0.1 mgm., or 5 scale divisions, per mgm. The beam is of hard-rolled brass, with agate knife edges, the outer mounts being adjustable. The rider gear is simple but efficient; a centre zero or left-hand zero can be provided as required, the former being supplied unless otherwise specified. There is normally a front-action release which controls arrestment and pan stops simultaneously, though side-action release can be supplied at a small extra charge if required. The base is of black glass, and the case of polished light oak, with two side doors and a counterpoised front slide. Internal dimensions of the case are 14½ by 8 by 14 in. high.



Personal Notes

MR. GEORGE CORNWELL has been appointed general manager of J. Allcock and Sons, Ltd., Oak Chemical Works, West Gorton, Manchester.

MR. R. G. FOXWELL, elder son of Dr. G. E. Foxwell, chairman of the British Chemical Plant Manufacturers' Association, has been awarded the B.A. degree of London University. Since the outbreak of war Mr. Foxwell has been employed with The Gas Light and Coke Company.

DR. CECIL H. DESCH has been appointed a director of Richard Thomas & Co., Ltd., to advise the company on matters of scientific research and development and to provide an essential link between the board and the company's staff of research chemists and

Dr. C. H. Desch.

metallurgists. This is a really concrete step towards the much-lauded (but not so much practised) policy of linking scientific knowledge and administrative working in industry. Dr. Desch's academic and research qualifications are well known, and the fact that he has been President of the Institute of Metals guarantees his familiarity with leading personalities in the metallurgical industry.

MR. A. J. GIBSON, Special Officer Lac Inquiry, at India House, relinquishes his duties under the Indian Lac Cess Committee on September 15, 1943, and from that date becomes Technical Adviser on Shellac to the Ministry of Supply. The Indian Lac Cess Committee has re-organised the London Shellac Research Bureau. The post of Special Officer Lac Inquiry will be abolished. The main staff will consist of the director, with a Lac Information Officer under him. Dr. B. S. GIDVANI will fill both posts, pending the arrival of a permanent incumbent for the latter position from India. The Lac Research Laboratory will remain in Edinburgh for the present.

DR. J. B. PHILLIPS, of the Canadian Department of Munitions and Supplies, has arrived in London from Montreal and joined the staff of Mr. Charles A. Banks, United Kingdom representative of the department. He will deal with matters pertaining to explosives and chemicals.

Scientists appointed to the Commission that is to inquire into higher education in the Colonies include PROFESSOR H. J. CHANNON, PROFESSOR A. V. HILL (secretary of the Royal Society), and DR. R. V. SOUTHWELL (rector of Imperial College of Science and Technology). Professor Channon, who vacates the chair of biochemistry at Liverpool University on September 1 to join the research staff of Messrs. Lever Bros. and Unilever, Ltd., is also a member of the commission dealing with higher education problems in British West Africa.

Obituary

MR. FREDERIC CHARLES BELL, who died at Purley, Surrey, on August 10, was formerly secretary of Consolidated Tin Smelters, Ltd., Eastern Smelting Co., Ltd., and other companies.

MR. RALPH TODD VINCENT, manager for Messrs. Wood and Fairweather, chemical manufacturers, Newcastle-upon-Tyne, has died at Sunderland, at the age of 66, after 51 years' service with the firm.

The death is announced of DR. E. C. V. MATTICK, who for thirty years was engaged on biochemical research at the National Institute for Research in Dairying, where her husband is head of the bacteriology department.

The death is announced of MR. WILLIAM R. WEBB, deputy chairman and director of Kodak, Ltd. He came to Europe from America, where he had been assistant superintendent of Eastman Kodak Company's chemical plant laboratory, and in 1931 he was appointed manager of Kodak's works at Harrow. Eight years later he was appointed a director of the firm.

MR. JAMES REGINALD LANE, who died suddenly, aged 56, at his home at Knowle, Warwickshire, on August 9, was well known in chemical and tar distilling circles. He was a director and chairman of Lancashire Tar Distillers, Ltd., North-Western Co-operative Tar Distillers, Ltd., Lane Bros. (Tar Distillers), Ltd., Lincolnshire Chemical Co., Ltd., Normanby Park Tar Supply Co., Ltd.; vice-chairman and director of South-Eastern Tar Distillers, Ltd.; and a director of National Benzole Co., Ltd., Johnson Bros. (Aylesford), Ltd., Creosote Producers' Association, Ltd., and Lennard and Co. (Shoreham-by-Sea), Ltd. He was president of the Association of Tar Distillers in 1934 and 1935.

General News

From Week to Week

The Coal Tar Controller, Ministry of Fuel and Power, has issued a direction to tar distillers in England and Wales to the effect that the whole of the country is now a shortage area. The scheme will come into force forthwith.

The annual meeting of the Gauge and Tool Makers' Association, Ltd., will be held in St. Ermin's Hotel, Caxton Street, S.W.1, on September 1. Membership of the Association, which was founded in August, 1942, now totals 75.

Great Northern and Southern Stores, Ltd., are negotiating the acquisition of a plastics company, according to a statement made by Mr. L. Percival Jackson, the chairman, at the annual meeting on Thursday last week.

That extremely useful little volume, "The Chemical Manufacturers' Directory," has made its appearance for 1943 at the same price of 5s. 6d. (post free, 6s.). This is the 75th annual edition and its usefulness is undiminished. It is printed and published by Newnham, Cowell & Gripper, Ltd., 21 City Road, E.C.1, for the proprietor, A. J. Pilbrow, and is obtainable of all booksellers.

The establishment of 29 new River Boards in England and Wales is recommended by the Central Advisory Water Committee, of which Lord Milne is chairman. It is suggested that these boards should be made solely responsible for the duties now carried out by catchment and fishery boards, and should be in charge of the prevention of pollution. It is stated that the present control system is inadequate and sometimes wasteful.

For the first time for many months, the Board of Trade index figure for the wholesale prices of chemicals and oils in July showed a decrease from the previous month's figure, having dropped from 145.8 to 145.3 (0.3 per cent.). The figures for iron and steel and for non-ferrous metals remain steady. The fall in the chemical figure resulted from the reductions of 13 to 6 per cent. in the respective prices of superphosphate and sulphate of ammonia.

A magnificent lead in the rehabilitation treatment of industrial workers has been given by the Miners' Welfare Commission, who on January 1 this year took over the residential centre at Berry Hill Hall, Mansfield, and are now developing further centres to serve all the major coalfield districts. Though the centres described are for the service of coal miners only, the brief account of their work, issued last month by the Miners' Welfare Commission, Ashtead, Surrey, makes interesting and encouraging reading, and is worth study by all branches of industry where injury demanding rehabilitation is likely to occur.

Sir John Anderson is reported to have stated during his recent visit to Washington that quantity production of penicillin will be expected to begin next year. The U.S.A. Government have ordered that penicillin shall be allocated for use only by the Armed Forces and for such civilian distribution as may be specifically authorised.

Foreign News

The Soviet Ambassador in Mexico states that there is no truth in the Press reports of the existence of a Russo-Mexican society to exploit Mexican petroleum.

An effective insecticide is being prepared from the leaves of the castor-oil plant at the New Jersey works of the Woburn Degreasing Company.

The import of citric acid into Canada, without a permit issued by the Minister of National Revenue, is prohibited by Order in Council.

Monsanto's styrene plant at Texas City is now in production. With a capacity of 50,000 tons a year, it will supply a substantial part of the needs of six Buna-S units.

An explosives plant with a daily output of 10,000 kg has been authorised by the Spanish Government. Machinery costing 635,000 pesetas is to be imported for the factory, which will be situated in Salamanca.

The largest starch factory in the world, that of the Corn Products Refining Co., at Pekin, Illinois, has shut down because of lack of corn. Output during the past two years has been 1,000,000 lb. of starch a day.

Rothamsted's centenary has been celebrated in Russia at a meeting held in the Moscow Scientists' Club. The part the station played in laying the foundations of agricultural chemistry was described by Professor Dmitri Prianisnikov.

A new plastics plant for the production of Plexiglas, the transparent material used for bomber noses and gun turrets, is being opened by Röhm and Haas at Knoxville, Tennessee, and will increase output of this product to 40 per cent. more than that at the outbreak of war. To complete the factory, second-hand equipment was mainly used.

Synthetic toluol production of the Shell Union Oil Corporation has been doubled in the past year, two new plants having been constructed. The proportion of synthetic toluol used in the T.N.T. manufacture has increased substantially since last year, when it was stated that two-thirds of American high explosives came from petroleum-derived toluol.

Brazil's tung oil output should reach 4000 tons a year when the 1,600,000 trees planted in the districts of S. Paulo and Paraná come to fruition.

Citric acid is among the many new chemical products being made in the S. Paulo district of Brazil. In addition to its extraction from lemon juice, via calcium citrate, it is being obtained in large quantities by the fermentation of the residual liquors of sugar mills.

Investment of about $2,000,000 in paint plants in Mexico City and in S. Paulo, Brazil, is planned by the Sherwin-Williams Co., American paint, varnish and enamel manufacturers, as an addition to the company's existing plants in Cuba and Argentina.

Australian Blue Asbestos Co., Ltd., has been formed in Western Australia, with a capital of £100,000, for the purpose of mining high-grade asbestos deposits. A processing factory is to be erected adjacent to the deposits, and the output will be marketed through the building material division of the Colonial Sugar Refining Company.

An industry-wide programme of co-operative textile research is envisaged in America. The directors of the Textile Research Institute, Inc., New York City, have unanimously approved plans for a five-point programme covering all branches of textile research, and the board has set up a finance committee to seek from the industry a fund of $2,000,000.

Production of alcohol from wheat without the addition of malt is made feasible by the discovery of two scientists of U.S. Department of Agriculture, A. K. Balls and I. W. Tucker, that the diastase in granular wheat flour can be activated so as to convert its own starch into fermentable sugars. The technique is being tested on a commercial scale.

Cyclonite was named by Dr. A. F. Thomson, of the Massachusetts Institute of Technology, in a recent lecture, as one of the new explosives that explode faster than T.N.T. He described these as being less sensitive, however, and said that the explosive used in naval shells can be fired through 16-in. armour plating without exploding, if the fuse is set in the safe position.

Rayon production in 1942 by Allgemeene Kunstzijde Unie N.V., Arnhem, was slightly smaller than in 1942, it is reported. The bulk of the output was marketed in Holland. The casein wool factory worked satisfactorily, but well under capacity, and has been closed since the end of 1942. The manufacture of staple fibre was begun early in 1943; the plant is valued in the balance-sheet at 5,650,000 fl. Selling prices of rayon have remained unchanged, but producing costs increased considerably, and the operating profit (after allowance for depreciation) declined from 9.23 to 5.83 mill. florins.

A patent (U.S.P. 2,322,734) has been issued to Dr. Egloff of the Universal Oil Products Co., Chicago, for a new hydrocarbon conversion process, described as useful in production of high anti-knock petrol. The process reforms a relatively light oil in the presence of a powdered dehydrogenating catalyst. Simultaneously it cracks a heavier hydrocarbon oil in the presence of a powdered catalyst while subjecting the mixture to continued conversion. It then separates the petrol from lower and higher boiling-point conversion products.

Forthcoming Events

The Association of Scientific Workers is holding a conference on "Science under Fascism and Democracy," at Birmingham Town Hall, on **August 22,** at 3 p.m. Professor M. L. E. Oliphant will preside, and speakers will include scientists representative of six Allied nations. After the addresses, films depicting scientific activities in many countries will be shown.

The annual general meeting of the Midland section of the **Institution of the Rubber Industry** will be held on **August 23.** The proceeding will be followed by a film show.

The Association of British Chemical Manufacturers, with the co-operation of the **British Chemical Plant Manufacturers' Association,** is organising a series of discussions on the practical aspects of the utilisation of fuel and power in chemical processes. The next in the series will be held at the College of Technology, Whitworth Street, Manchester, at 5 p.m., on **August 25.** The subjects will be "Heating by Liquids" and "Heat Exchangers (including the Use of Effluents)." Brief introductions by Mr. B. N. Reavell and Mr. H. F. Goodman, respectively, will be followed by discussions and questions. Non-members will be welcome and should notify Mr. W. Murray (The Liverpool Borax Co., Ltd., Maxwell House, 6 St. Paul's Square, Liverpool, 3), not later than August 21, of their attention to attend.

Company News

Metal Industries, Ltd., have declared a final dividend of 5½ per cent., making 8 per cent. for the year (5 per cent.).

The Zinc Corporation has declared a final ordinary dividend of 10 per cent. for 1942, making 20 per cent. (same).

Harben's (Viscose Silk Manufacturers), Ltd., report a net profit, for the year ended April 30, of £25,943 (£19,898). One year's arrears of dividend at 8 per cent. on the first preference shares is being paid (same) for the year to December 14, 1932.

The Anchor Chemical Co., Ltd., has declared an interim dividend of 10 per cent. (same).

The United Molasses Co., Ltd., announce a net profit of £349,321 for the year ended December 31, as against £373,355. The ordinary dividend is maintained at 22½ per cent., and carry forward is £74,452 (£73,081).

The Anglo-Iranian Oil Co., Ltd., is paying a final dividend of 15 per cent., making 20 per cent. for 1942 (7½ per cent.), this being the highest distribution since 1938. Net profit is £7,790,282 (£3,292,315); forward, £1,378,667 (£1,187,119).

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

PICKUPS LTD, London, W.C., chemists (M., 21/8/43) July 23, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank, not ex. £25,000, from the company and/or International Laboratories, Ltd.; charged on Weycroft Lodge, Arterberry Road, Wimbledon. *——. December 30, 1942.

Satisfactions

CARLTON CHEMICAL CO., LTD., Birmingham. (M.S., 21/8/43.) Satisfaction July 28, £300, registered April 25, 1917.

KOKO-MARICOPAS CO., LTD., London, E.C., manufacturing chemists, etc. (M.S., 21/8/43.) Satisfaction July 26, of debentures registered April 16, 1926, to the extent of £1000.

New Companies Registered

Carlton Laboratories, Ltd. (382,109).—Private company. Capital: £1000 in 1000 shares of £1 each. Manufacturers of and dealers in chemicals, drugs, medicines, fertilisers, disinfectants, etc. Subscribers: T. Williams; Wm. J. Fullerton. Registered office: 46-47 Auckland Street, Lambeth, S.E.11.

Test House, Ltd. (382,131).—Private company. Capital: £1000 in 1000 shares of £1 each. Designers, fitters and maintainers of test houses for examining and testing materials used in the chemical and radio industries, etc. Stanley G. Howden-Simpson is the first director. Registered office: 230 Acton Lane, Chiswick, W.4.

Domestic Chemical Compounds, Ltd. (382,093).—Private company. Capital: £1000 in 1000 shares of £1 each. To acquire the business of chemical manufacturers carried on by Clifford Moore and John R. Archibald at 217 Westgate Road, Newcastle-on-Tyne, manufacturers of and dealers in cleaning and scouring preparations, grease and paint removers, etc. Directors: Clifford Moore; John R. Archibald. Registered office: 217 Westgate Road, Newcastle-on-Tyne.

Chemical and Allied Stocks and Shares

ACTIVITY in most sections of the Stock Exchange has been on a reduced scale, and the tendency in industrial shares was reactionary, although in most cases only a small part of recent gains was not held. Hopes of post-war prospects continued to be the main influence governing markets, but it would seem that some securities have reached levels which discount rather fully the possibility of a better trend in dividends after the war.

There were again many individual features of strength, but prices fluctuated sharply in some instances, particularly British Celanese, which remained under the influence of the possibilities of the plastics interests of the company and hopeful views as to the post-war dividend outlook. Nevertheless, the current level of 34s., although below the best reached in the past few days, compares with 31s. 6d. a week ago. Thomas De La Rue were higher and transferred up to £7⅛. British Industrial Plastics 2s. shares made further improvement to 6s. 4½d., and Erinoid showed dealings ranging up to 12s. 7½d. Imperial Chemical at 39s. 3d. were unchanged on balance, while B. Laporte were firmly held and again 78s. Triplex Glass remained under the influence of hopes of a return to higher dividends after the war, and on balance improved further from 36s. 7½d. to 37s. 1½d. Similar hopes again influenced Lever & Unilever, which at 37s. 6d. were slightly higher, while Lever N.V. moved up to 35s., compared with 33s. 9d. a week ago. Moreover, Turner & Newall at 80s. 6d. were again higher. On the other hand, the recent advance in Associated Cement attracted selling, and the price has reacted slightly to 64s. 6d. at the time of writing. Wall Paper Manufacturers deferred reacted from 42s. 6d. to 41s., and British Oxygen had an easier appearance, the disposition in this case being to await the forthcoming interim dividend announcement. Borax Consolidated deferred improved from 36s. to 36s. 9d., General Refractories from 16s. 9d. to 17s. 3d., and British Plaster Board from 28s. 6d. to 28s. 9d.

There were again only small movements

among iron and steel securities. Tube Investments at 91s. 9d. were slightly above the level of a week ago, as were Stewarts & Lloyds at 52s. 3d., while United Steel were 25s., Colvilles 23s. 3d., and Staveley 53s. 9d. Elsewhere, Goodlass Wall 10s. ordinary moved back to 16s., Lawes Chemical were 12s., and Monsanto Chemicals 5½ per cent. preference 23s. 6d. W. J. Bush ordinary remained firmly held and quoted at 53s. 9d., Fisons were 52s. 6d., and Burt Boulton again 19s. Greeff-Chemicals 5s. ordinary were 7s. 3d., and B.D.H. ordinary 23s. Dealings around 3s. 6d. have been recorded in British Emulsifiers 2s. shares.

British Aluminium remained at 49s. 6d. Amalgamated Metal at 19s. 9d., and British Match at 39s. 7½d. were virtually the same as a week ago. Gas Light & Coke ordinary, which remained under the influence of the resumption of interim dividend payments, were 19s. 6d. Imperial Smelting eased to 15s. 6d., and Murex at 100s. were below the level of a week ago. Textile issues have been less active, including British Celanese, which, however, were higher on balance. Moreover, Courtaulds at 55s. 3d. were also higher compared with a week ago. Bradford Dyers, on which resumption of dividends for the current year continues to be talked of in the market, were 21s. Whereas Calico Printers ordinary eased, the preference units were better at 19s. 9d., awaiting the decision as to a payment on account of dividend arrears.

Boots Drug have been a good feature with an improvement from 43s. to 43s. 9d. at the time of writing. Sangers were higher at 23s., but elsewhere, Timothy Whites moved back to 31s. 1½d. The units of the Distillers Co. were firm at 86s. 9d., and inclined to improve. United Molasses ordinary, under the influence of satisfaction with the results and annual statement, were 31s. 9d., compared with 31s. a week ago. Earlier gains in oil shares, which followed the good impression created by the Anglo-Iranian dividend, have not been fully held at the time of writing.

British Chemical Prices

Market Reports

QUIET conditions prevail in most sections of the London chemical market with the price position showing little, of any, alteration. With regard to deliveries against contracts the movement is steady and in the aggregate fairly substantial, while the amount of new business reported during the week is comparatively small. In the soda products section nitrate and bicarbonate of soda are receiving a steady inquiry, while the demand for chlorate of soda exceeds the quantities available. Hyposulphite continues an active market and a moderate trade is in evidence for acetate of soda. Among the potash chemicals, values for yellow prussiate of potash remain nominal, and a steady inquiry is reported for acid phosphate and caustic potash. Offers of permanganate of potash are finding a ready outlet and priority users are quickly absorbing the limited supplies of bichromate. In other directions a brisk demand is reported for acetone and formaldehyde, while arsenic is a good market. There has been no outstanding feature in the coal tar products market this week and the inquiry for new business has been on a moderate scale. There is a steady call for creosote oil, carbolic acid and cresylic acid. Fair quantities of pitch are being taken up and naphthalene is steady.

MANCHESTER.—Notwithstanding holiday conditions which are still making their influence felt on the Manchester chemical market, both on contract deliveries and on new business, there has been a fair movement of supplies to consumers against old orders, though fresh bookings are still no more than moderate. Most of the soda compounds, including caustic, nitrate, bicarbonate and soda ash, are being absorbed in reasonably good quantities, and there is a fair call for supplies of the sulphate. In the potash section offers are finding a ready outlet. The heavy acids are meeting with steady inquiry. Quotations throughout the range are on a firm basis.

GLASGOW.—There is no actual change in the position in the Scottish heavy chemical trade during the past week. Home business remains steady. Export trade is still rather restricted. Prices remain very firm.

Second-hand
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for sale.

VERTICAL totally enclosed Mild Steel STEAM JACKETED MIXER, 6 ft. 0 in. dia. by 8 ft. 6 in. deep; dished bottom and bolted-on dished cover; fitted vertical glanded agitating shaft overdriven through gearing from f. & l. pulleys; two sets of internal steam coils, manhole, sundry connections, etc.

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Horizontal MIXER by Baker Perkins, with mild steel tilting "U" shaped pan, 3 ft. 3 in. by 2 ft. 6 in. by 2 ft. 0 in. deep, arranged with double scroll type blades driven through gearing from f. & l. pulleys; power operated tilting mechanism and reversing clutch.

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